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Lower Incisor Retraction with a Modified Corticotomy

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ABSTRACT

This case report demonstrates the orthodontic treatment facilitated with a new conservative corticotomy technique to shorten the treatment time during lower incisor retraction. The patient was a 22-year-old woman with protrusive profile, severe anterior crowding, an anterior crossbite, and Class III dental relationship. Orthodontic treatment consisted of the extraction of four first premolars with maximum anchorage. A modified corticotomy technique, in which the lingual vertical and subapical horizontal cuts were eliminated, was combined with orthodontic therapy for the retraction of the lower anterior teeth. Corticotomy-facilitated orthodontics dramatically reduced the treatment time without any adverse effects on the periodontium and the vitality of the teeth. The main advantages of this modified corticotomy technique were the elimination of the lingual cuts and flap, the reduction of surgery time, and minimum discomfort to the patient. At the end of active orthodontic therapy,

balanced occlusion and facial esthetics were achieved.

INTRODUCTION Return to TOC

Many surgical procedures have been combined with conventional orthodontics for better treatment of severe dentoalveolar abnormalities. Among these procedures, surgical alveolar corticotomies have been used for years in correction of malocclusions.

Corticotomy is defined as the osteotomy of the cortical bone.[1] In adult patients, this technique dramatically reduces the treatment time because the resistance of the dense cortical bone to orthodontic tooth movement is removed.[1–4] Also, corticotomy-facilitated orthodontics enables the limitation of the undesirable adverse effects of the orthodontic therapy, such as root resorption and periodontal damage.[5] The alveolar corticotomy technique has been revised and changed over the years[1,2,5] to eliminate possible risks of the procedure, such as periodontal damage and devitalization of the teeth and osseous segments because of inadequate blood supply. The aim of this report is to present the rapid and effective modified alveolar corticotomy-facilitated orthodontic treatment of an adult case with severe malocclusion.

CASE REPORT Return to TOC

Diagnosis and Etiology

A 22-year-old Vietnamese female patient with a chief complaint of severe anterior crowding showed a protrusive facial profile (Figure 1A–C). The oral hygiene was not adequate in the anterior region because of the irregularity. Her intraoral examination revealed 3.5 mm of diastema between maxillary incisors caused by a recently extracted mesiodens, Angle Class III canine relationship, and anterior crossbite. The maxillary and mandibular crowding were −8 mm and −6 mm. Deviation of upper and lower midlines was noted. Slight gingival recession was detected in the labially positioned left lower central incisor (Figures 2A–E and 3A–E).

Radiographic Examination

The panoramic radiographic examination revealed that the patient's right upper third molar was congenitally absent and all the other third molars were present. No fillings, carious lesions, or periodontal defects were observed (Figure 4).

When evaluated according to the patient's racial norms, cephalometric measurements showed an average maxilla with maxillary depth angle of 92°, SNA of 82° and an average mandible with facial depth angle of 88° and SNB of 79°. Witts value was −2 mm. A lower facial height angle of 46°, facial axis angle of 87°, and mandibular plane angle of 30° indicated a mesofacial growth pattern. The upper incisors were slightly retroclined (U1-APo angle = 27° and U1-APo distance = 6 mm), whereas the lower incisors were inclined labially (L1-APo angle = 31° and L1-APo distance = 8 mm). The lower lip protrusion was 3 mm with respect to the esthetic plane (Figure 5 and Table 1).

Treatment Objectives

The treatment objectives included the improvement of the protrusive profile; elimination of maxillary and mandibular dental crowding, midline deviation, and anterior crossbite; closure of diastema; and correction of dental relationship. To attain the objectives, the extraction of four first premolars with maximum anchorage mechanics was planned.

Treatment Progress

After extraction of four first premolars, a combination of Nance and Transpalatal appliance was placed in the maxilla. A lingual retainer was used in the lower dental arch for anchorage control. Orthodontic treatment started with segmental canine distalization in the maxillary dental arch to create space for maxillary lateral incisors in crossbite. When enough space was obtained, maxillary central incisors were bonded and the diastema was closed with elastic chain.

Before mandibular canine distalization, the bite was opened with bite raisers (Guray Bite Raiser, GAC International Inc, Bohemia, NY) to avoid possible interferences between mandibular canines and maxillary lateral incisors during canine distalization. At the final stages of mandibular canine distalization, the patient reported that she would return to her country and asked for the acceleration of her orthodontic treatment. Therefore, a corticotomy-facilitated lower incisor retraction was planned to reduce the remaining treatment time.

The interdental bone and the proximity of the roots of the teeth were evaluated on the panoramic and occlusal radiographs. Although the slight gingival recession of the left central incisor at the beginning of the treatment was still evident, the periodontal examination revealed a healthy periodontium with pocket depths ranging between 1 and 2 mm. The patient was fully informed of the proposed surgical procedure and signed an informed consent. Maxillary and mandibular 0.016- × 0.022-inch stainless steel retraction arches with T loops were inserted 1 week before corticotomy.

Surgical Procedure

A modified corticotomy procedure was carried out under local anesthesia. A mucoperiosteal flap was elevated labially beyond the apices of the lower incisors (Figure 6). The greatest mesiodistal width of the incisors guided the vertical

bone cuts in the cortical bone from the gingival margin to 2–3 mm below the apices of the teeth (Figure 7 ⊙▬). The vertical cuts were performed from the distal of the right lower lateral incisor to the distal of left lower lateral incisor with a 0.5-mm diameter stainless steel round bur. These vertical cuts were deepened in the cortical bone about 1.5–2 mm and extended to spongiosa. A chisel was then used for reaching the lingual cortical bone from labial side. In this modified corticotomy technique, labial and lingual supra-apical horizontal and lingual vertical cuts were not performed, and the corticotomy site was not mobilized. After bleeding control, the flap was repositioned and closed primarily.

The lower consolidation arch was immediately activated after corticotomy because the time span between surgical procedure and tooth movement was very critical (Figure 8A,B ⊙▬). In the third week, the overjet was eliminated and the extraction spaces were almost closed (Figure 9A–C ⊙▬). The lower incisor retraction was finalized in 1½ months. Before debonding, the dentition was stabilized with rigid arch wires. During 2 months of bone consolidation, additional intermaxillary elastics were used to improve the interdigitation. After active orthodontic treatment, the patient was instructed to wear maxillary and mandibular Hawley retainers.

Treatment Results

At the end of treatment, the protrusive facial profile was improved (Figure 10A–C ⊙▬). The crowding was eliminated, the diastema was closed, and Class I molar and canine relationships with normal overjet and overbite were established (Figures 11A–E ⊙▬ and 12A– E ⊙▬). However, it was noted that maxillary lateral incisors needed to receive more labial root torque. Periodontal examination of lower anterior teeth revealed no marked increase in pocket depths or gingival recession.

On the panoramic and periapical radiographs taken at the end of treatment, well-aligned and parallel roots of the teeth were noted. No periapical process or resorption of the roots was detected in the lower incisors (Figure 13A,B ⊙▬).

The final lateral cephalometric measurements and the superimpositions of the initial and final lateral cephalometric radiographs revealed that the lower facial height was increased, the upper and lower molars and incisors were extruded, the lower incisors were retracted, and the upper and lower lips were slightly retruded by orthodontic treatment (Figure 14A,B ⊙▬ and Table 1 ⊙▬).

A balanced occlusion and facial esthetics were achieved after 16 months of active orthodontic therapy.

DISCUSSION

The orthodontic treatment of this Angle Class III case with severe crowding, anterior crossbite, and protrusive profile could have been successfully accomplished with conventional orthodontics. However, the need for accelerating the treatment progress to meet the patient's expectations during the intermediate

phases of the therapy resulted in the combination of orthodontic treatment with a surgical procedure.

Alveolar corticotomies have been commonly used in conjunction with orthodontics. Concerns about the possible risks of corticotomy procedure have led to the modification of this technique. The original technique described by Köle[1] included a combined interradicular corticotomy and supra-apical osteotomy. Although the results of the Köle osteotomies were stable, pulp mortifications were not rare.[6] Later, the supra-apical osteotomy was replaced by corticotomy, and labial and lingual corticotomy cuts were used to circumscribe the roots of the teeth.[3,5]

Generally, the conventional corticotomy techniques include both labial and lingual cuts[2–5] and sometimes require two-stage surgery.[4,7,8] Although the clinical healing was uneventful, some complications such as subcutaneous hematomas of the face and the neck could occur after intensive corticotomies.[3] However, in our modified mandibular corticotomy technique, the lingual vertical and subapical cuts were not performed and lingual flap was not elevated, whereas the access to the lingual cortical bone was achieved from the labial side. The main purpose of this conservative, one-stage surgery was to reduce the operation time and postoperative patient discomfort.

The mandibular anterior region is a critical site when the blood supply is considered. The periodontal angioarchitectonics are found to be different in labial and lingual surfaces of the lower incisors, and the density of the capillary networks is unequal.[9] Therefore, corticotomy procedures may require some modifications in this gentle area. Generson et al[2] also proposed some modifications such as the elimination of vertical cuts when there is risk to damage the teeth. In the mandible, where the roots of the anterior teeth are close and where the lingual surgical access of the bony structures is limited, this modified corticotomy technique can be safely used.

In our modified mandibular corticotomy technique, lingual subapical horizontal and vertical cuts were not performed so as to support the blood supply of the mandibular dentoalveolar region by lingual mucosa and to protect the thin roots of the incisors in the region where there is difficult access and possibility of damaging the teeth. Labial subapical horizontal cuts were omitted to protect overlying cortical bone and to maintain the blood supply of the incisors because the spongiosa bone was not left intact. Although some animal experiments and case reports regarding the effects of segmental alveolar movement after corticotomy revealed no damages in the pulp and no adverse effects on the periodontium of the teeth,[2,3,10] it was also reported that reactive inflammation of pulp and vacuolar degeneration in maxillary anterior teeth were observed after protraction with two-stage corticotomy in the maxilla.[7] After our modified surgery, no problems of inadequate blood supply, devitalization of the teeth, root resorption, or gingival recession occurred.

In the developmental process of corticotomy procedure, the marginal bone was

excluded from the operation side in an attempt to protect the crestal bone and periodontal membrane, which may be highly vulnerable after subapical osteotomies accompanied by vertical corticotomies.[10] In accordance with these instructions, the vertical cuts were advised to begin 2– 3 mm below the alveolar crest in a technique proposed by Suya.[5] However, in our modified technique, because the crestal bone and the periodontal membrane were supported by the intact lingual mucosa, the vertical cuts were extended to the gingival margin on the buccal side with no adverse effects at the end of treatment.

Reduction of orthodontic therapy time is considered to be an important goal in the management of malocclusions. Corticotomy has been proposed as an alternative to conventional orthodontic treatment in difficult adult cases for rapid tooth movement.[1] In the present case, corticotomy-facilitated lower incisor retraction was accomplished in 1½ months. Chung et al[4] reported that the complete retraction of anterior teeth combined with corticotomy in a case with severe bimaxillary protrusion took less than 3½ months. According to the clinical observations of Düker,[10] the required position of the teeth after corticotomy could be achieved even earlier than 1½–3 months.

In the current case report, the total orthodontic treatment time (16 months) was dramatically reduced when compared with the average treatment time for extraction therapy (31 months).[11,12] In corticotomy-facilitated orthodontics, the reduction of orthodontic treatment time by approximately 50% was observed.[3]

The earlier concept of the rapid tooth movement was based on bony block movement in corticotomy techniques including buccal and lingual vertical and subapical horizontal cuts circumscribing the roots of the teeth. According to Suya,[5] the tooth embedded within a block of medullary bone served as the handle by which the bands of less-dense medullary bone surrounding the teeth were moved block by block. On the other hand, the latest concept on the rapid tooth movement after corticotomy is supported by the regional acceleratory phenomenon (RAP), described as accelerated bone turnover and decreased regional bone density.[8] The RAP mechanism potentiating tissue healing was shown to occur in the mandible as well as in long bones.[13] Wilcko et al[14] presented cases treated in approximately 6 months with combined corticotomy-facilitated orthodontics and periodontal alveolar augmentation called Accelerated Osteogenic Orthodontics. In most of their nonextraction cases, both labial and lingual vertical and subapical corticotomies and selective decortification were performed and a bone-augmentation procedure was added to protect the periodontium during expansive tooth movements.[8,14] In an attempt to clarify the mode of tooth movement after corticotomy, pre- and posttreatment computed tomography (CT) scans were compared, and the findings indicated a demineralization-remineralization phenomenon rather than a bony block movement.[8,14] Because the CT scans or histolologic findings were not available in the present case treated with our corticotomy technique, it was not likely to definitely state the nature of tooth movement. However, the rapid tooth movement seemed to mostly depend on RAP rather than bony block movement because the lingual cortical bone was left intact and bone blocks surrounding teeth were not

formed. Furthermore, labial vertical cuts, which were deepened into the spongiosa reaching lingual cortical bone, might help RAP diffuse in the mandibular anterior region and in the lingual cortical bone. The wounding of the lingual cortical bone to stimulate RAP was performed from the labial side in contrast to the two-sided corticotomies. It was also demonstrated that, during healing of bone defects, a systemic acceleratory phenomenon occurs in the cancellous bone compartment in addition to RAP.[15] Unfortunately, the published data on the explanation of the accelerated tooth movement concept during corticotomy-facilitated orthodontics are based on few case reports.[8,14] Therefore, controlled studies with an increased number of subjects are required. Furthermore, the need for double-sided corticotomies should be investigated because our single-sided approach appears to be sufficient to stimulate rapid tooth movement.

CONCLUSIONS [Return to TOC]

- Corticotomy-facilitated orthodontics is an effective treatment alternative in adults with severe malocclusion to decrease the treatment time and increase the quality of treatment.

- The use of this modified technique could be beneficial for adult patients with difficult surgical access from the lingual side.

- The reduction of operation time and patient discomfort by our cost-effective and conservative corticotomy technique, which eliminates the lingual approach, are basic advantages of this method. However this procedure should be carefully applied with respect to the teeth, bone, and surrounding tissues to avoid the risk of devitalization of the teeth and periodontal damage.

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TABLES Return to TOC

TABLE 1. Cephalometric Values with Racial Norms

Cephalometric Value	Initial	Final	Norm
Maxillary depth angle (°)	92	92	92
SNA (°)	82	81	82
Facial depth angle (°)	88	87	88
SNB (°)	79	78	80
Witts value (mm)	−2	0	−1
Lower facial height (°)	46	48	44
Facial axis angle (°)	87	84	88
Mandibular plane angle (°)	30	31	25
U1-APo angle (°)	27	25	32
U1-APo distance (mm)	6	5	6
L1-APo angle (°)	31	15	23
L1-APo distance (mm)	8	3	3
Lower lip to E plane (mm)	3	1	0